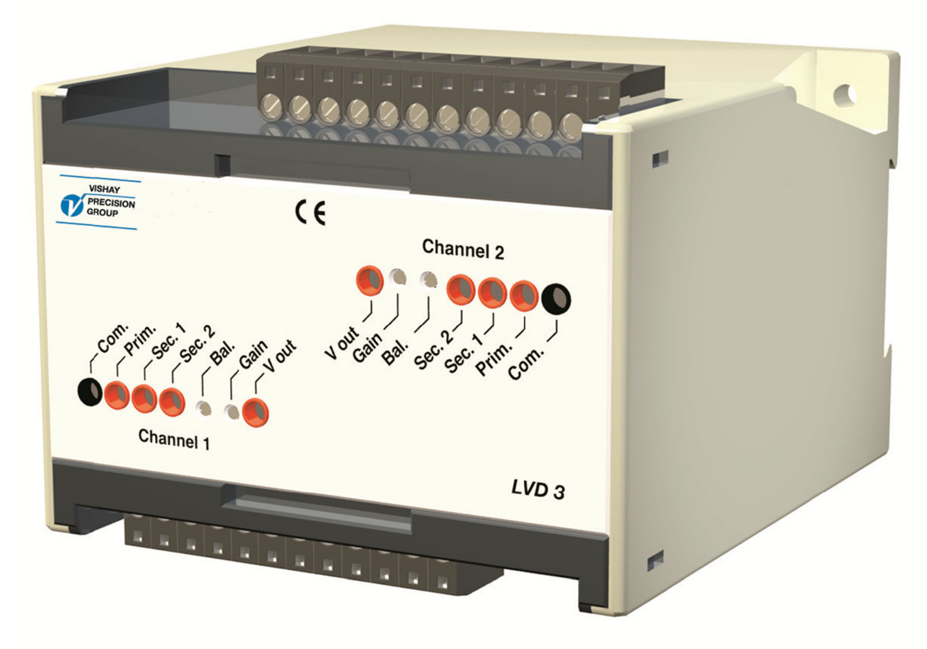
Measurement · Weighing · Control

GB

LVDT Signal conditioner
LVD 3



Operating and Installation instructions

VISHAY PRECISION GROUP

Contents

INTRODUCTION

OPERATING INSTRUCTIONS

INSTALLATION

FAULT FINDING

APPENDICES

Introduction

General

Figure 1.

LVD 3 is a signal conditioner module, designed for use together with two position transducers, type LVDT, thus forming two channels for position measurement.
The outputs from each channel are analogue voltage and a current loop.

The channels are galvanically isolated from each other and from the power supply.

The compact module is easily installed on a DIN-rail or attached by two screws on a flat surface. All electrical connections to LVD 3 are made through one plug-in terminal block for each channel. Adjustment potentiometers and test sockets are accessible at the front panel.

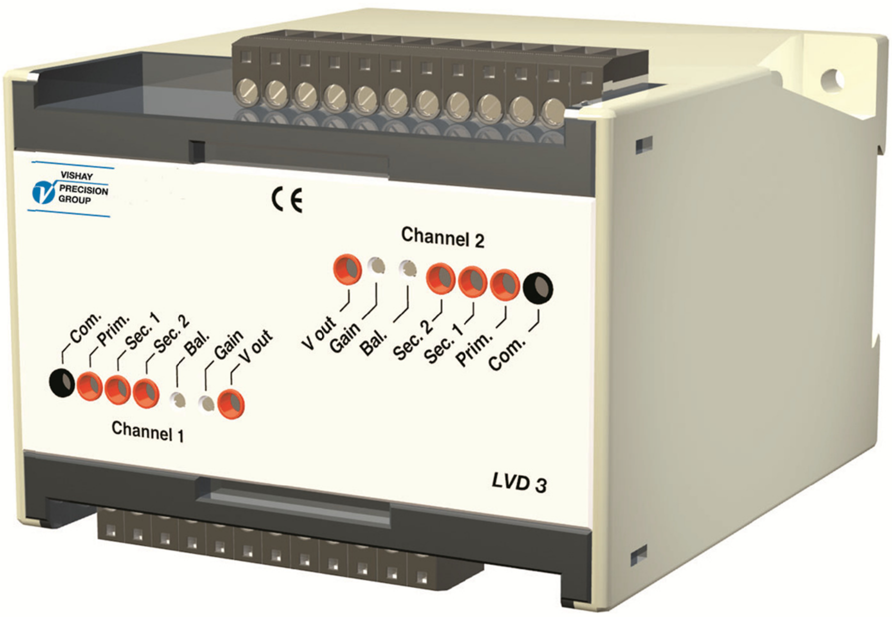


Figure 1. Signal conditioner LVD 3.

Functions

Figure 2.

Each channel of the signal conditioner includes an oscillator with amplitude control, supplying the transducer primary coil with AC voltage.

The amplitude control function sets the oscillator amplitude so that the primary voltage, or the mean value of the secondary voltages, remains constant relative to the internal reference. Using feedback of the secondary signals reduces influence on the position measurement from temperature and from cables.

The inputs for the secondary coils have high impedance to avoid load on the trans-ducer. After phase detection, the two signals are combined to a bipolar voltage signal that is filtered, giving a DC voltage signal proportional to the core position in the transducer.

Gain for the position signal is adjusted by a potentiometer in one of three ranges, selected by switches. Zero offset for the signal is also adjusted by a potentiometer.
The position signal is a current loop (4 to 20 mA) and a monopolar voltage (0 to +10 V DC) or a bipolar voltage (-10 to +10 V DC).

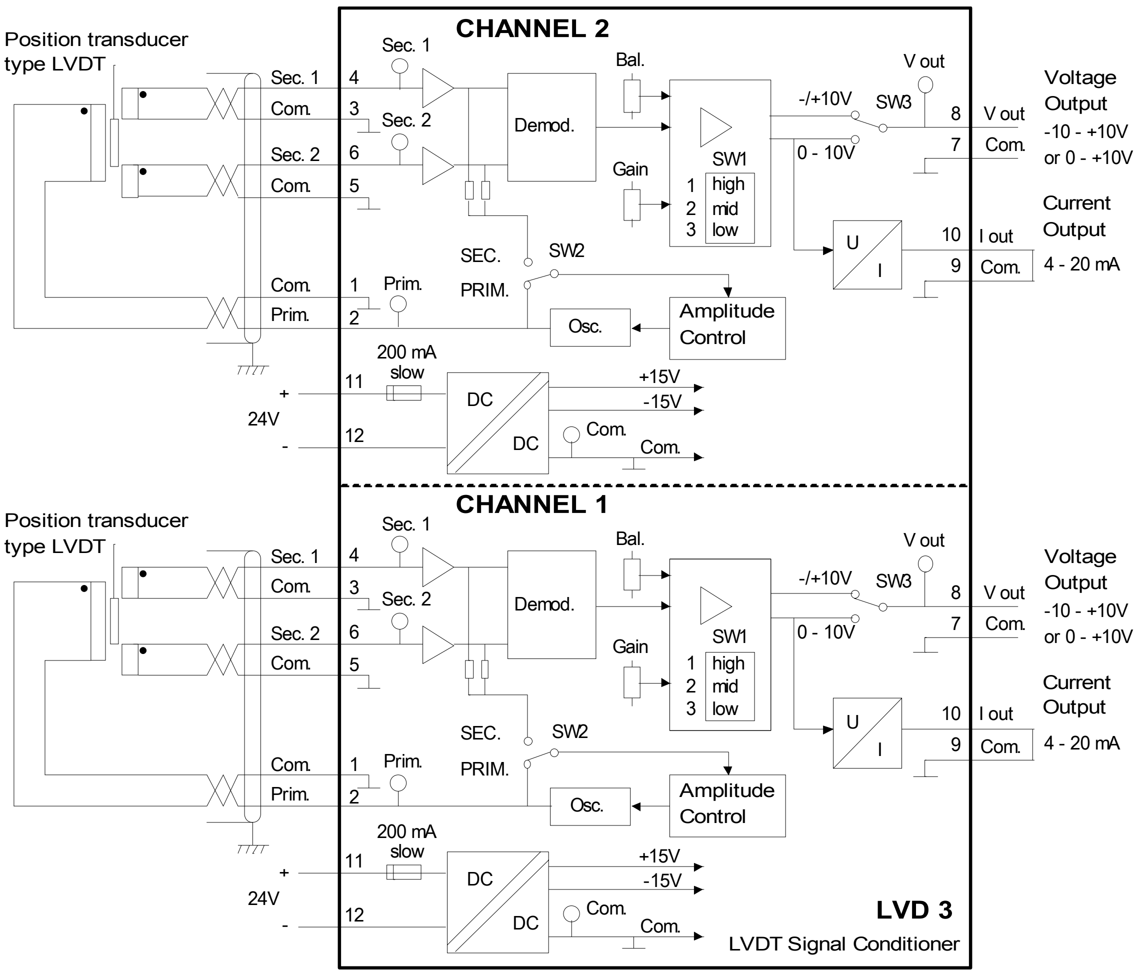


Figure 2. LVD 3 block diagram.

Technical data

Oscillator for primary coil

Frequency	2.5 – 3.2 kHz
Frequency stab.	±1 %
Distortion	max. 4 %
Signal	max. 6 V AC, 150 mA
Amplitude stab.	±0.1 %

Inputs for secondary coils

Input voltage	max. 6.8 V
Input impedance	min 150 kohm

Outputs

Voltage output is selectable as Bipolar or Monopolar.

Bipolar voltage	±10 V, R_{load} >6 kohm
Monopolar voltage	0 – 10 V, R_{load} >6 kohm
Current output	4 – 20 mA, R_{load} <500 ohm
Linearity	±0.05 %
Offset adjust. range	±2 – ±7 % of range
Offset drift	max. 2 mV
Gain ranges	low: 2.1 – 5.8
(differential AC input	mid: 5.2 – 15
to bipolar DC output)	high: 14 – 39
Gain drift	max. 0.1 %
Filter bandwidth	125 Hz (-3 dB)

Power supply (per channel)

Supply voltage	24 V DC ±20 %
Fuse	200 mA, slow
Continuous current	<120 mA
Surge current	250 mA

CE conformity

EMC	industrial, process

Temperature range

Operation	0 – +50 ºC
Storage	-25 – +85 ºC

Mechanical

Mounting rail	DIN 46 277/3 or DIN EN 50022 (35 mm)
Box dimension	75 x 100 x 110 mm
Protection	IP 20
Test sockets	2 mm

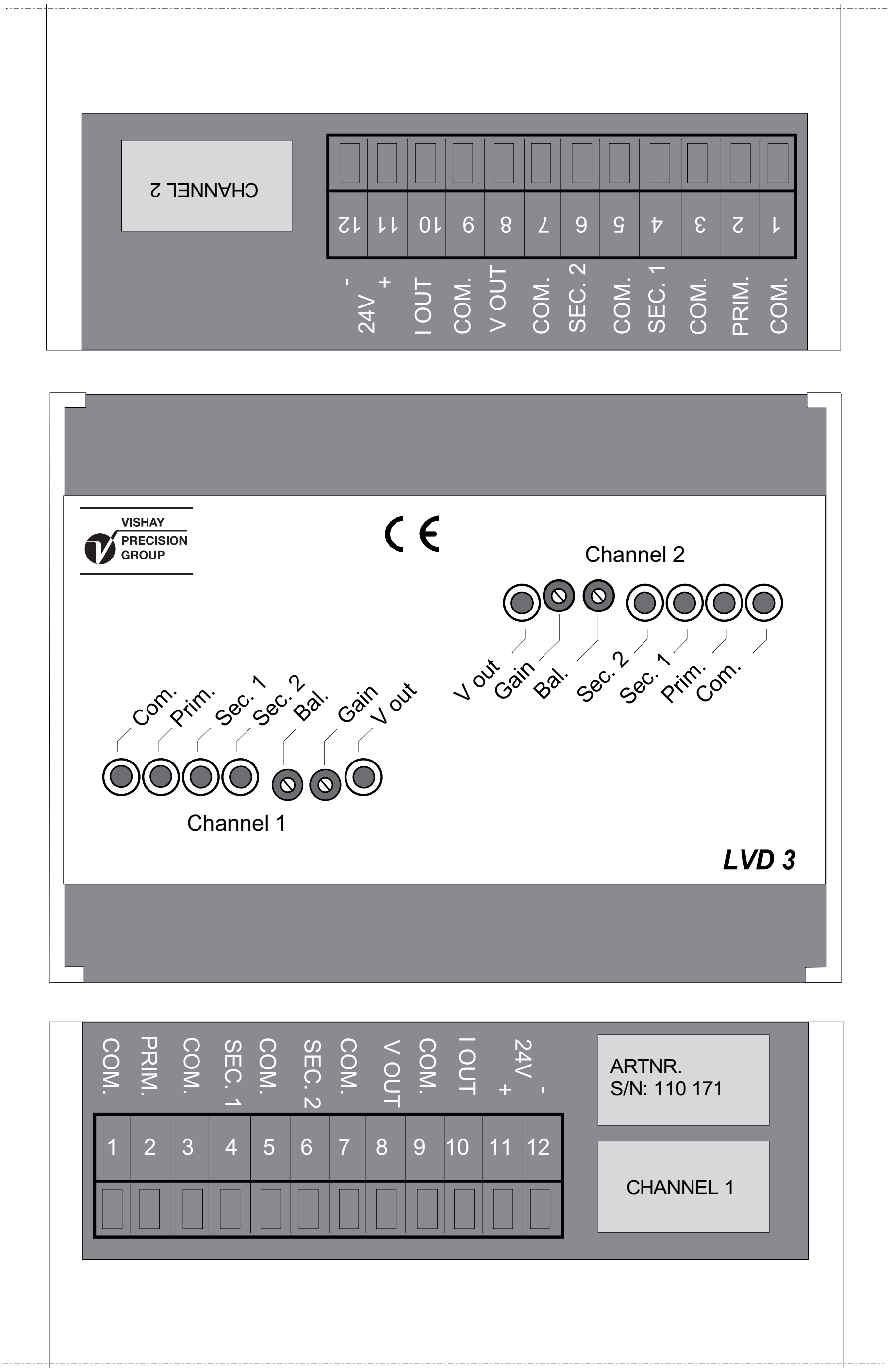


Figure 3. Potentiometers and test sockets for both channels are accessible at the front panel. All connections to one channel are made through a single plug-in terminal block on one side of the LVD 3 module.

OPERATING INSTRUCTIONS

General

Figure 3.

The LVD 3 module front panel has adjustment potentiometers for gain and zero offset of both channels. In addition all important measuring points are accessible in test sockets at the front.

To fully exploit the measurement range of the transducer, correct adjustment of the zero offset for the channel is important. The core centre position for a differential transformer (e.i. a type LVDT transducer) is an extremely accurate reference which should therefore coincide with the centre of the output signal range.

Assume that one channel of LVD 3 is set for an output signal of -10 to +10 V. Then, with correct adjustment, 0 V will correspond to the core centre position for the connected transducer. Consequently, -10 and +10 V will correspond to the limits of the measurement range for the connected transducer.

Potentiometers

Gain – Adjustment of gain for the channel.

Bal. – Adjustment of zero offset for the channel.

Adjustment of gain and zero offset is thoroughly described in the INSTALLATION section.

Test sockets

Figures 2 and 3.

Com. – Measurement reference.

Prim. – Output signal to the transducer.

Sec. 1 – Input signal from the transducer.

Sec. 2 – Input signal from the transducer.

V out – Voltage output.

(Values of the transducer signals depend on feedback, transducer type and transducer core position.)

Use of the test sockets is thoroughly described in the FAULT FINDING section.

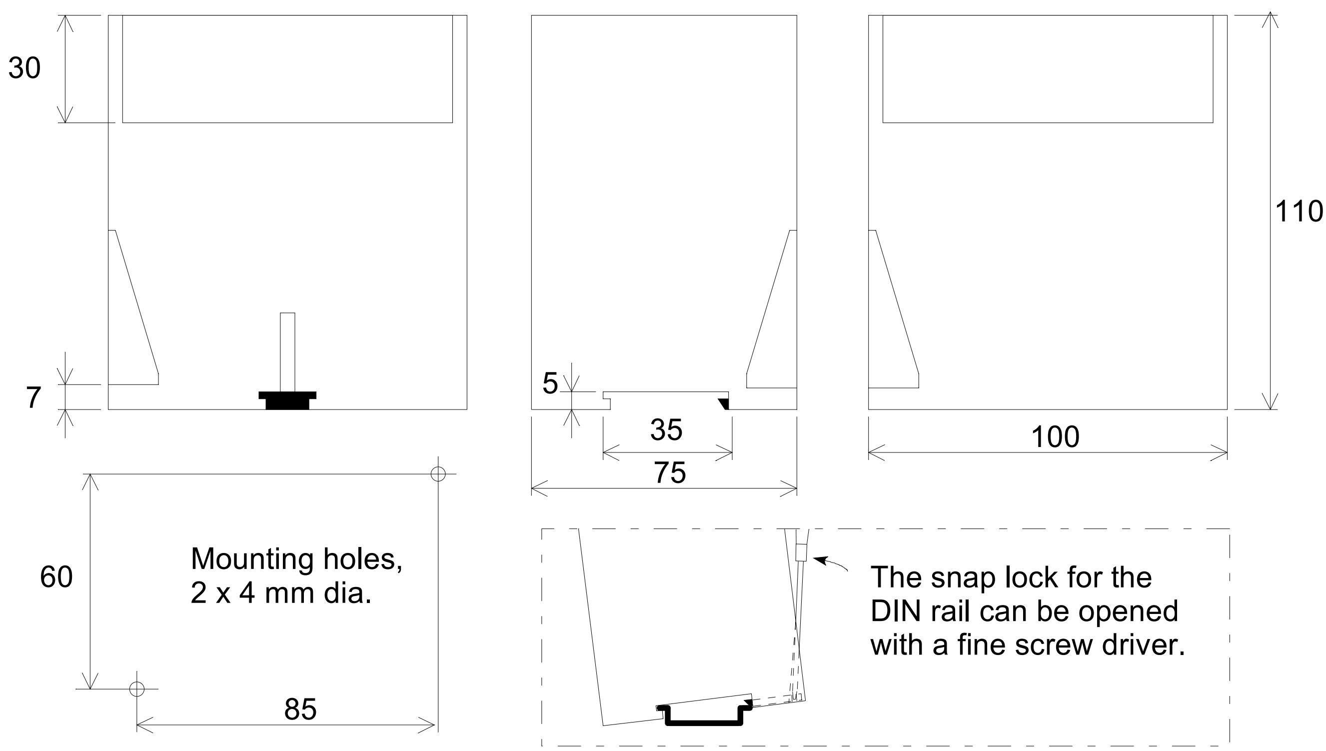


Figure 4. Mechanical dimensions for LVD 3.

INSTALLATION

General

Figure 4.

The module is intended for mounting on standard 35 mm DIN-rails.
During installation various parameters and configurations are set by
switches and potentiometers on the circuit board.

Connections

Figure 2.

24 V supply

Connect +24 V to terminal 11 and 0 V_{24} to terminal 12.

Transducers

Use screened cables with twisted pairs. Connect the primary coil to terminals 1 and 2. Connect one secondary coil to terminals 3 and 4 and the other to terminals 5 and 6.

To reverse the measuring direction for one transducer, change places for the secondary coil connections. See figure 2, terminals 3 / 4 and 5 / 6.

Output signals

Two output signals are available for each channel:

> one current loop output, 4 – 20 mA, from terminal 10 to terminal 9.
>
> one voltage output, 0 – +10 V or -10 – +10 V, at terminal 8
> with 0 V reference at terminal 7.

The voltage output can also be measured at test socket V out (reference Com.).

Set-up procedure

General

Figure 5.

Each channel has a separate circuit board with test sockets, potentiometers and switches for selection of feedback type, gain range and type of voltage output.

To give access to the switches, the module front panel should be removed.
Then the switches SW1 and SW3 on the outer edge of the circuit board can be reached. To reach switch SW2, press the side walls of the box apart to release the circuit board, and pull it out.

Switch settings at delivery are shown in a table at Appendix 1.

Feedback selection

Figure 5.

Two feedback types for amplitude control of the oscillator are available. Either ‘PRIM.’: feedback of the primary voltage to the transducer (default setting), or ‘SEC.’: feedback of the mean value of the transducer secondary voltages.
Set switch SW2 on the circuit board accordingly.

Certain transducers are manufactured with linearization, which makes the mean value of the secondary voltages dependent on the core position. These transducers must be used with feedback type ‘PRIM.’.

Transducers for which the mean value of the secondary voltages is independent of the core position, within the linear range, can be used with feedback type ‘SEC.’. Check that the oscillator output doesn’t exceed 6 V AC!
Feedback type ‘SEC.’ gives a considerably reduced influence on the measurement from temperature variations and cable length.

Calibration

General

The two channels are identical, so the calibration is carried out in the same way for both channels.

Adjusting the zero point

Figure 5.

For a position transducer, type LVDT, the core centre position is an accurate reference point. It should correspond to the centre of the output signal range (0 V for bipolar and +5 V for monopolar voltage, 12 mA for current loop).
Setting of this zero reference point should be performed in four steps:

STEP 1:
Set the amplifier gain in medium range by the switches SW1:
SW1, no.1 and no.3 to OFF,
SW1, no.2 to ON.
Then adjust the transducer core to an approximate centre position.
(This will bring the AC voltage between test sockets Sec. 1 and Sec. 2 close to 0 V. If not, the transducer connection is probably not correct; one of the secondary coils must be phase reversed.)
STEP 2:
Connect test socket Sec. 1 to Sec. 2.
Then use potentiometer Bal. to adjust the output signal to the centre of its range (0 V, +5 V, or 12 mA).
STEP 3:
Adjust the moving machine component to the required centre position.
STEP 4:
Remove the connection Sec. 1 to Sec. 2.
Then adjust the transducer core mechanically, without changing the machine part position, to bring the output signal to the centre of its range (0 V, +5 V, or 12 mA).
Fine adjusting of the zero reference point may be necessary after changing the gain setting.

Adjusting the gain

Figure 5.
The gain is to be adjusted so that maximum output signal is obtained when the moving machine part is in its maximum position. The measuring range can be reversed, to make the output change in the correct direction, by switching the connections for the transducer secondary coils (terminals 4 and 6).

First use SW1 to select the medium gain range (SW1, no.2 set to ON, SW1, no.1 and no.3 set to OFF).
Then set the moving machine part in the required maximum position.
Read the output signal and use potentiometer Gain to adjust it.
Turn clockwise to increase the output signal, turn counter clockwise to decrease it.

If a sufficiently high output signal cannot be obtained, the high gain range must be selected by SW1 (SW1, no. 3 set to ON, SW1, no. 2 and no. 1 set to OFF).
If a sufficiently low output signal cannot be obtained, the low gain range must be selected by SW1 (SW1, no. 1 set to ON, SW1, no. 2 and no. 3 set to OFF).

If the gain range has been changed by SW1, STEP 2 under ‘Adjusting the zero point’ should be executed again, and then the connection Sec. 1 to Sec. 2 must be removed. Finally potentiometer Gain can be adjusted so that the required output signal is obtained with the moving machine part in maximum position.

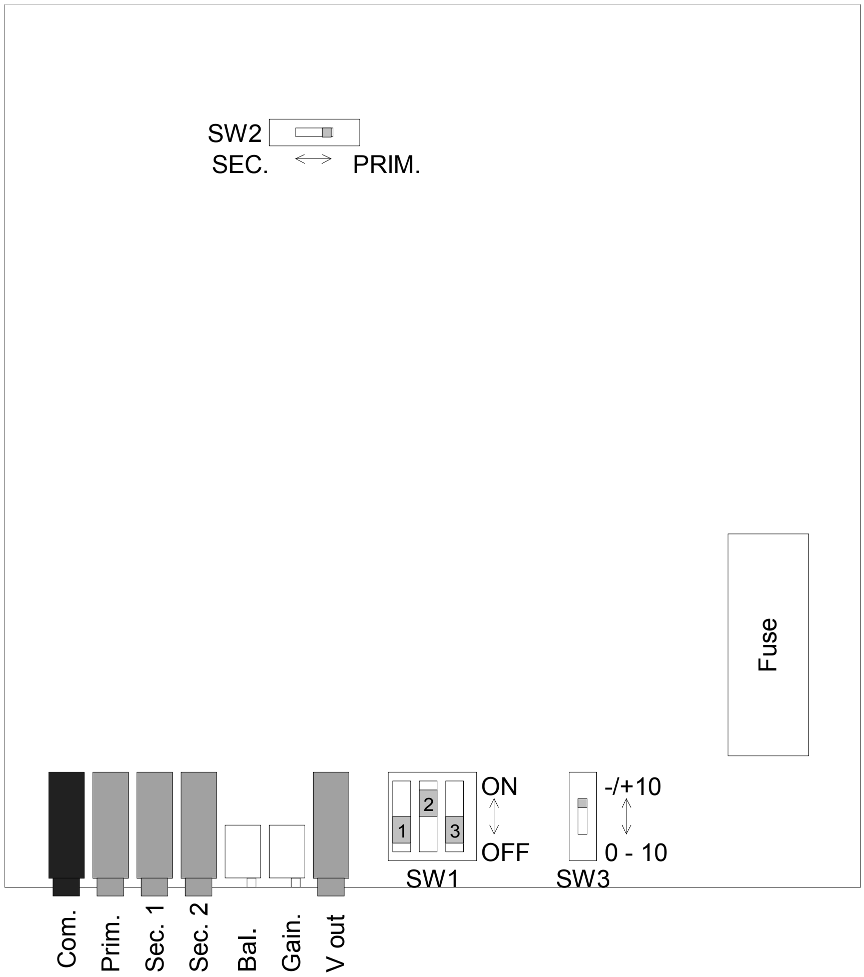


Figure 5. Location of switches on a LVD 3 circuit board.

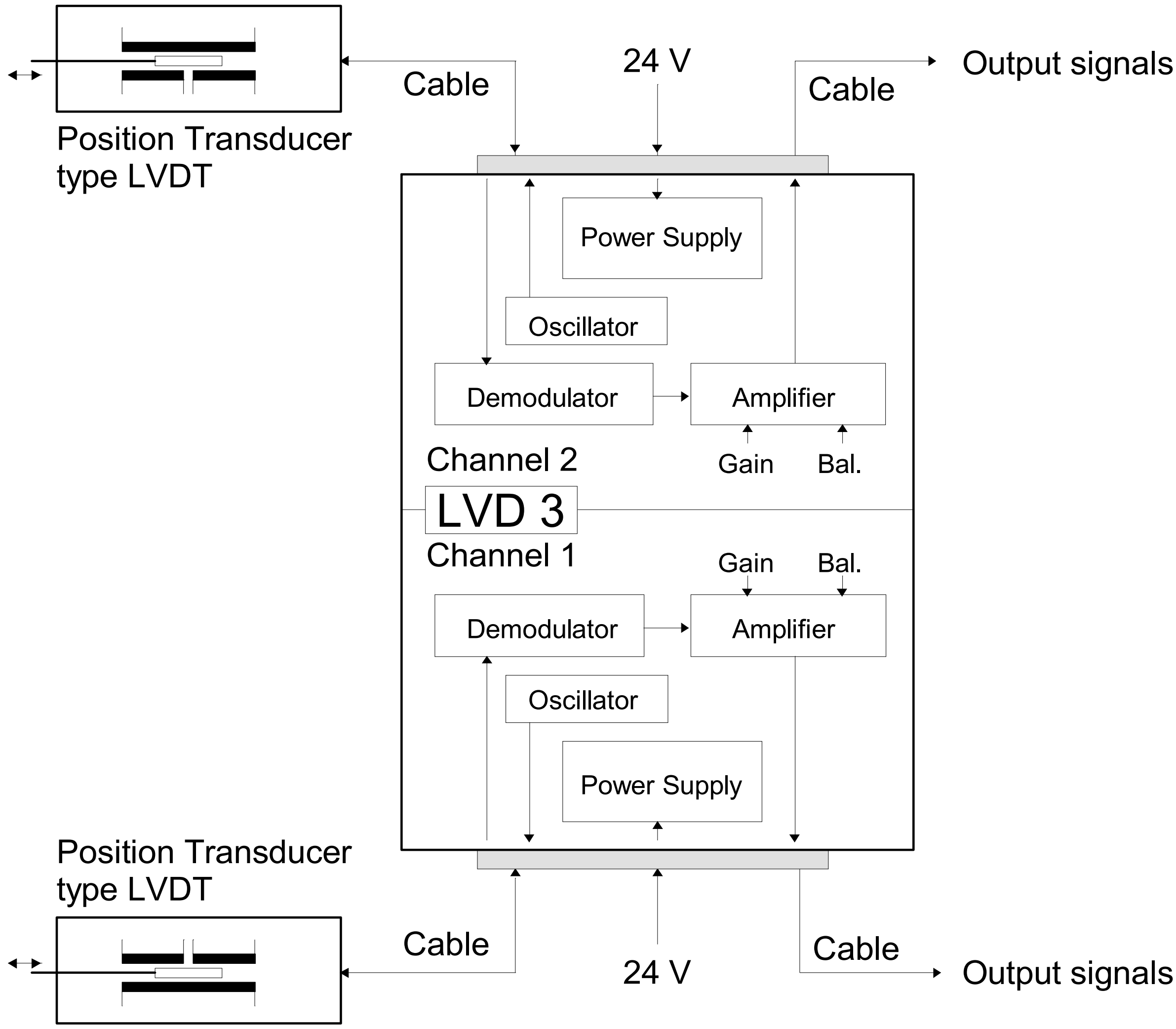


Figure 6. System for position measurement.

FAULT FINDING

General

Figure 6.

We shall concentrate on describing fault finding in a measurement system including the signal conditioner module. Fault finding and repair work inside the module should only be carried out by Thermo Nobel.

The two channels are identical and the fault finding procedure is equal for both channels.

Successful position measurement requires that all units in the system work properly: transducer, cables and signal conditioner module.
With simple means it is possible to determine whether a unit is operating or not.

The signal paths of the system can be measured with the power on or off.

Transducers

Use a multimeter, set to resistance measurement, to check that the transducer coil resistances correspond to the values in the transducer specification.
Generally the primary coil has the lowest resistance and the secondary coils mutually have the same resistance.

Check the transducer attachment and that the core and core connecting rod are properly fitted.

Transducer cables

Figure 2.

The resistance of the cables can be measured separately to check for open circuits or short circuits. The cables can also be checked with the transducers connected,
in which case the difference in impedance must be insignificant compared with measurement on the transducer only.

Signal conditioner module

Figures 2 and 5.

First check the connections and that all relevant switch settings on the board have been done. Select primary feedback, (SW2 in position 'PRIM.') to simplify the fault finding.
Then check the module in conjunction with the transducer.

Power supply

Check the power supply to the module, measuring with a DC voltmeter:
+24 V DC at terminal 11, 0 V_{24} at terminal 12.

Observe that the module has one internal fuse for each channel.

Output from oscillator

Check the output signal from the oscillator to the transducer primary coil, measuring with an AC voltmeter:

- 3.3 – 3.5 V AC at terminals 1 and 2.

If there is no voltage, disconnect the transducer and check the output again. If there is still no voltage, (NOTE, SW2 must be set for primary feedback), it indicates that the internal fuse may be blown. In other cases there is a fault in the oscillator, and the circuit board must be changed.

If the fault disappeared, the transducer and transducer cable must be checked with respect of short-circuits.

If the oscillator function is correct you can proceed and check the input signals from the transducer.

Input signals from transducer

Input signals to LVD 3 from the transducer can be checked at the test sockets Sec. 1 and Sec. 2. First ensure that the transducer primary coil is supplied from the oscillator, measuring at test sockets Prim. – Com. (3.3 – 3.5 V AC).

Then check the AC voltage at Sec. 1 – Com. and Sec. 2 – Com. respectively. Check that the voltage decreases for one coil and increases for the other when the transducer core position is changed.

Also check that the AC voltage between Sec. 1 and Sec. 2 is close to zero when the transducer core is in the centre position. If not, the connections for one of the secondary coils must be reversed.

If this checking with primary feedback is satisfactory, faults in the oscillator, transducer and transducer cable can be excluded.

If feedback of the secondary voltages will be used, this feedback type for amplitude control of the oscillator must also be checked.
Change to secondary feedback (SW2 in position 'SEC.').
Measure the AC voltage at:

- test sockets Sec. 1 – Com.
- test sockets Sec. 2 – Com.

for a few different transducer core positions.

Calculate the mean value of each pair of measured voltages.

These mean values shall be equal to the voltage at test sockets Prim. – Com., measured earlier with primary feedback setting (3.3 – 3.5 V AC).

The actual voltage Prim. – Com. must be less than 6 VAC, or the transformer ratio of the transducer is not suitable for secondary feedback.

Output signals

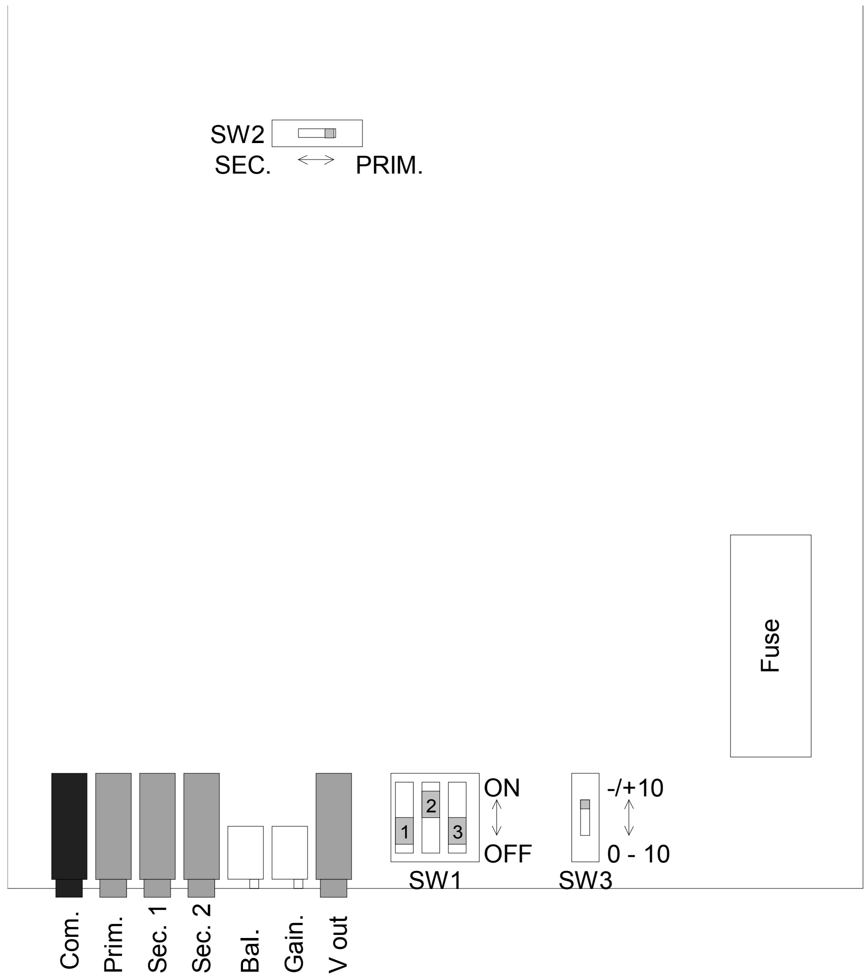
Disconnect the output load and check that output signals are obtained in response to transducer core movements over the entire measuring range as follows:

- Bipolar output: ±10 V DC at test sockets V out – Com.
- Monopolar output: 0 – +10 V DC at test sockets V out – Com.
- Current output: 4 – 20 mA from terminal 10 to terminal 9, using an ammeter
  or
  2 – 10 V DC across a 500 ohm resistor, connected to terminals 10 and 9.

Cables with load

Disconnect the output cables from LVD 3 and measure the load resistance, including the cables, with a multimeter:

- Load for the current output must not exceed 500 ohms
- Load for the voltage output must exceed 6 kohms.



Component side of LVD 3 circuit board.
Equal for Channel 1 and Channel 2.

Table of settings for LVD 3.

General

*To be filled in at installation (* = default value).*

Manu. order No.: ....

Date: ....

Serial No.: ....

Transducer 1

Supply voltage: V

Resistance: .... ohm

Transducer 2

Supply voltage: V

Resistance: .... ohm

Feedback selection, SW2

Channel 1:

Primary	*[ ] PRIM.
Secondary	[ ] SEC.

Channel 2:

Primary	*[ ] PRIM.
Secondary	[ ] SEC.

Output selection, SW3

Channel 1:

Monopolar	[ ] 0–10.
Bipolar	*[ ] -/+10.

Channel 2:

Monopolar	[ ] 0–10.
Bipolar	*[ ] -/+10.

Gain adjustment, SW1

Channel 1:

Gain 14 – 39 (high)	[ ]	SW1:	No.1=ON.	No.2=OFF.	No.3= OFF.
Gain 5.2 – 15 (mid)	*[ ]	SW1:	No.1=OFF.	No.2=ON.	No.3=OFF.
Gain 2.1 – 5.8 (low)	[ ]	SW1:	No.1=OFF.	No.2=OFF.	No.3=ON.

Channel 2:

Gain 14 – 39 (high)	[ ]	SW1:	No.1=ON.	No.2=OFF.	No.3=OFF.
Gain 5.2 – 15 (mid)	*[ ]	SW1:	No.1=OFF.	No.2=ON.	No.3=OFF.
Gain 2.1 – 5.8 (low)	[ ]	SW1:	No.1=OFF.	No.2=OFF.	No.3=ON.

Appendix 1.

Table of settings.

Declaration of Conformity

We Nobel Elektronik AB
Box 423, S-691 27 KARLSKOGA
SWEDEN

declare under our sole responsibility that the product

LVD 3,
LVDT Signal Conditioner

to which this declaration relates is in conformity with the following standards or other normative documents

EMC:

SS-EN 55011 (1991)	/ SS EN 50081-2 (1993):	Class A, Group 1
SS-ENV 50140 (1993) / SS-EN 50082-2 (1995): SS-EN 61 000-4-3 (1996)		10 V/m
ENV 50141 (1993) SS-EN 61 000-4-6 (1996)	/ SS-EN 50082-2 (1995):	10V
SS-EN 61000-4-2 (1995)	/ SS-EN 50082-2 (1995):	4 kV Contact discharge 8 kV Air discharge
SS-EN 61 000-4-4 (1995)	/ SS-EN 50082-2 (1995):	2 kV DC Mains 2 kV Control

The product to which this declaration relates is in conformity with the essential requirements in the EMC Directive 89/336/EEC with amend. 92/31/EEC and 93/68/EEC.
The product is supplied by 24 VDC and is therefore not covered by the requirements in the Low Voltage Directive 73/23/EEC

KARLSKOGA Jun 26 2000...
Bengt-Åke Sjögren, Managing Director

Appendix 2.

Declaration of Conformity

Document no. 35181
Article no. 600 382 R5

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